

CLAIMS

WHAT IS CLAIMED:

1. A system for controlling a hydraulic actuator in a remote locale, said hydraulic actuator adapted to operate when provided with a sufficient pressure, said system comprising:
a first hydraulic cylinder;
an isolated supply of fluid provided to said first hydraulic cylinder, said isolated supply of fluid positioned in an environment that is at a pressure other than atmospheric pressure;
an actuator device coupled to said first hydraulic cylinder, said actuator device adapted to drive said first hydraulic cylinder to create said sufficient pressure in said fluid;
and
at least one hydraulic line operatively intermediate said first hydraulic cylinder and said hydraulic actuator, said at least one hydraulic line supplying said sufficient pressure in said fluid to said hydraulic actuator in said remote locale.
2. The system of claim 1, wherein said remote locale is subsea, and said operation of said hydraulic actuator opens a downhole safety valve.
3. The system of claim 1, wherein said actuator device is an electric motor and gear assembly.

4. The system of claim 1, further comprising:

a hydraulic fluid supply reservoir for storing a quantity of said supply of fluid, said fluid in said hydraulic fluid supply reservoir at a pressure that is less than said sufficient pressure; and
an operation control valve in said at least one hydraulic line selectively positionable to put said hydraulic actuator in fluid communication with either of said first hydraulic cylinder and said hydraulic fluid supply reservoir.

5. The system of claim 1, further comprising:

a bypass control valve operatively connected to said first hydraulic cylinder to permit said actuator device to drive said first hydraulic cylinder without substantially increasing a pressure of said fluid.

6. The system of claim 1:

wherein said first hydraulic cylinder comprises a movable pressure barrier, a first chamber and a second chamber, and wherein said first chamber is adapted to be in fluid communication with said supply of fluid, said second chamber is adapted to be selectably in fluid communication with said hydraulic actuator; and
a bypass control valve selectively providing fluid communication between said first chamber and said second chamber.

7. The system of claim 1, further comprising:

a resupply line and a resupply coupling, said resupply coupling adapted to interface with
an external source of fluid; and

said resupply line being positioned intermediate said resupply coupling and said
hydraulic supply reservoir.

8. The system of claim 1, further comprising:

a second hydraulic cylinder having at least one chamber; and

a fluid flow line in fluid communication with said at least one chamber in said second
hydraulic cylinder, said fluid flow line adapted to allow pressure to be supplied to
said chamber in said second hydraulic cylinder to thereby drive said first
hydraulic actuator.

9. The system of claim 8, wherein:

said fluid flow line is a water injection flow line.

10. The system of claim 8, wherein said first hydraulic cylinder has a first movable
pressure barrier positioned therein and said second hydraulic cylinder has a second movable
pressure barrier positioned therein, said first and second movable pressure barriers being
operatively coupled together such that movement of said second movable pressure barrier causes
movement of said second movable pressure barrier.

11. The system of claim 8, wherein said first hydraulic cylinder has a first movable pressure barrier positioned therein and said second hydraulic cylinder has a second movable pressure barrier positioned therein, said first and second movable pressure barriers being operatively coupled to one another to provide synchronous movement of said first and second movable pressure barriers.

12. The system of claim 10, wherein said first and second movable pressure barriers are operatively coupled together by coupling a shaft of said first hydraulic cylinder to a shaft of said second hydraulic cylinder.

13. The system of claim 8, wherein said first hydraulic cylinder has a first movable pressure barrier and said second hydraulic cylinder has a second movable pressure barrier, said first and second movable pressure barriers being operatively coupled to one another to provide synchronous movement between the first and second movable pressure barriers, said second movable pressure barrier having a pressure bearing surface area that is greater than a pressure bearing surface area of said first movable pressure barrier.

14. The system of claim 1, wherein said hydraulic fluid is comprised of seawater.

15. A system for controlling a hydraulic actuator in a subsea well, comprising:
a first hydraulic cylinder;
an isolated subsea source of hydraulic fluid provided to said first hydraulic cylinder;

an actuator device coupled to said first hydraulic cylinder, said actuator device adapted to drive said first hydraulic cylinder to pressurize said fluid; and
at least one hydraulic line for supplying said pressurized fluid to said hydraulic actuator in said subsea well.

16. The system of claim 15, wherein said hydraulic actuator is adapted to open a downhole safety valve when said pressurized fluid is supplied to said hydraulic actuator.

17. The system of claim 15, wherein said system further comprises a downhole safety valve and wherein said hydraulic actuator in said subsea well comprises a single-acting hydraulic cylinder having an actuator piston and a return spring, said actuator piston being movable between a first position in which said downhole safety valve is open, and a second position in which said downhole safety valve is closed, said actuator piston being movable to said first position when said pressurized fluid is supplied to said single-acting hydraulic cylinder, and said actuator piston being movable to said second position by said return spring when said single-acting hydraulic cylinder is vented to thereby allow a pressure of said pressurized fluid to be reduced.

18. The system of claim 15, wherein said actuator device comprises an electric motor.

19. The system of claim 15, further comprising a first control valve disposed between said hydraulic cylinder and said hydraulic actuator in said subsea well, said first control valve having at least a first position which allows said pressurized fluid to be supplied to said hydraulic

actuator in said subsea well and a second position which vents said pressurized fluid in said hydraulic actuator in said subsea well to thereby reduce a pressure of said pressurized fluid.

20. The system of claim 15, wherein said actuator device comprises a second hydraulic cylinder having at least one chamber therein.

21. The system of claim 20, further comprising a water injection flow line in fluid communication with said at least one chamber in said second hydraulic cylinder, said water injection flow line adapted to allow pressurized water to be supplied to said chamber in said second hydraulic cylinder to thereby drive said first hydraulic actuator.

22. The system of claim 20, wherein said first hydraulic cylinder has a first movable pressure barrier positioned therein and said second hydraulic cylinder has a second movable pressure barrier positioned therein, said first and second movable pressure barriers being operatively coupled together such that movement of said second movable pressure barrier causes movement of said second movable pressure barrier.

23. The system of claim 20, wherein said first hydraulic cylinder has a first movable pressure barrier positioned therein and said second hydraulic cylinder has a second movable pressure barrier positioned therein, said first and second movable pressure barriers being operatively coupled to one another to provide synchronous movement of said first and second movable pressure barriers.

24. The system of claim 22, wherein said first and second movable pressure barriers are operatively coupled together by coupling a shaft of said first hydraulic cylinder to a shaft of said second hydraulic cylinder.

25. The system of claim 20, wherein said first hydraulic cylinder has a first movable pressure barrier and said second hydraulic cylinder has a second movable pressure barrier, said first and second movable pressure barriers being operatively coupled to one another to provide synchronous movement between the first and second movable pressure barriers, said second movable pressure barrier having a pressure bearing surface area that is greater than a pressure bearing surface area of said first movable pressure barrier.

26. A method of controlling a hydraulic actuator, said hydraulic actuator adapted to operate when provided with a sufficient pressure, said method comprising:

providing an isolated supply of fluid;

providing fluid from said isolated supply of fluid to a first hydraulic cylinder that is actuated to create said sufficient pressure in said fluid, said first hydraulic cylinder being operatively connected to said hydraulic actuator by at least one hydraulic line; and

communicating said sufficient pressure to said hydraulic actuator via said at least one hydraulic line.

27. The method of claim 26, further comprising:

actuating an operation control valve positioned in said hydraulic line to place said hydraulic actuator in fluid communication with said first hydraulic cylinder or a hydraulic fluid supply reservoir, said reservoir adapted to store fluid at a pressure that is less than said sufficient pressure.

28. The method of claim 27, further comprising:

resupplying fluid to said isolated supply of hydraulic fluid through a resupply line and a resupply coupling, said resupply coupling adapted to interface with an external source of hydraulic fluid, and said resupply line operatively intermediate said resupply coupling and said hydraulic supply reservoir.

29. The method of claim 28, further comprising:

filling said first hydraulic cylinder with a portion of said supply of hydraulic fluid by opening a bypass control valve selectively providing fluid communication between a first chamber and a second chamber of said first hydraulic cylinder, said first chamber in fluid communication with said supply of hydraulic fluid, and said second chamber in fluid communication with said hydraulic actuator.

30. The method of claim 26, further comprising:

providing a second hydraulic cylinder, said second hydraulic cylinder having at least one chamber, and a fluid flow line in fluid communication with said at least one chamber in said second hydraulic cylinder; and

supplying a fluid to said at least one chamber of said second hydraulic cylinder via said fluid flow line adapted to allow pressure to be supplied to said chamber to thereby drive said first hydraulic actuator.

31. The method of claim 30, wherein said fluid flow line is a water injection flow line.